

# INTERNATIONAL STANDARD

# IEC 62305-1

First edition  
2006-01

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## Protection against lightning – Part 1: General principles

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## PROTECTION AGAINST LIGHTNING –

## Part 1: General principles

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International Standard IEC 62305-1 has been prepared by IEC technical committee 81: Lightning protection.

The IEC 62305 series (Parts 1 to 5), is produced in accordance with the New Publications Plan, approved by National Committees (81/171/RQ (2001-06-29)), which restructures and updates in a more simple and rational form the publications of the IEC 61024 series, the IEC 61312 series and the IEC 61663 series.

The text of this first edition of IEC 62305-1 is compiled from and replaces

- IEC 61024-1-1, first edition (1993).

The text of this standard is based on the following documents:

FDIS	Report on voting
81/262/FDIS	81/267/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted, as close as possible, in accordance with the ISO/IEC Directives, Part 2.

IEC 62305 consists of the following parts, under the general title *Protection against lightning*:

Part 1: General principles

Part 2: Risk management

Part 3: Physical damage to structures and life hazard

Part 4: Electrical and electronic systems within structures

Part 5: Services<sup>1</sup>

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
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<sup>1</sup> To be published



## INTRODUCTION

There are no devices nor methods capable of modifying the natural weather phenomena to the extent that they can prevent lightning discharges. Lightning flashes to, or nearby, structures (or services connected to the structures) are hazardous to people, to the structures themselves, their contents and installations as well as to services. This is why the application of lightning protection measures is essential.

The need for protection, the economic benefits of installing protection measures and the selection of adequate protection measures should be determined in terms of risk management. Risk management is the subject of IEC 62305-2.

The criteria for design, installation and maintenance of lightning protection measures are considered in three separate groups:

- the first group concerns protection measures to reduce physical damage and life hazard in a structure is given in IEC 62305-3,
- the second group concerns protection measures to reduce failures of electrical and electronic systems in a structure is given in IEC 62305-4,
- the third group concerns protection measures to reduce physical damage and failures of services connected to a structure (mainly electrical and telecommunication lines) is given in IEC 62305-5.

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# PROTECTION AGAINST LIGHTNING –

## Part 1: General principles

### 1 Scope

This part of IEC 62305 provides the general principles to be followed in the protection against lightning of

- structures including their installations and contents as well as persons;
- services connected to a structure.

The following cases are outside the scope of this standard:

- railway systems;
- vehicles, ships, aircraft, offshore installations;
- underground high pressure pipelines;
- pipe, power and telecommunication lines not connected to a structure.

NOTE Usually these systems are under special regulations made by various specific authorities.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62305-2, *Protection against lightning – Part 2: Risk management*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

IEC 62305-5, *Protection against lightning – Part 5: Services*<sup>2</sup>

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### **lightning flash to earth**

electrical discharge of atmospheric origin between cloud and earth consisting of one or more strokes

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<sup>2</sup> To be published.

### 3.2

#### **downward flash**

lightning flash initiated by a downward leader from cloud to earth

NOTE A downward flash consists of a first short stroke, which can be followed by subsequent short strokes. One or more short strokes may be followed by a long stroke.

### 3.3

#### **upward flash**

lightning flash initiated by an upward leader from an earthed structure to cloud

NOTE An upward flash consists of a first long stroke with or without multiple superimposed short strokes. One or more short strokes may be followed by a long stroke.

### 3.4

#### **lightning stroke**

single electrical discharge in a lightning flash to earth

### 3.5

#### **short stroke**

part of the lightning flash which corresponds to an impulse current

NOTE This current has a time to the half value  $T_2$  typically less than 2 ms (see Figure A.1).

### 3.6

#### **long stroke**

part of the lightning flash which corresponds to a continuing current

NOTE The duration time  $T_{\text{long}}$  (time from the 10 % value on the front to the 10 % value on the tail) of this continuing current is typically more than 2 ms and less than 1 s (see Figure A.2)

### 3.7

#### **multiple strokes**

lightning flash consisting on average of 3-4 strokes, with typical time interval between them of about 50 ms

NOTE Events having up to a few dozen strokes with intervals between them ranging from 10 ms to 250 ms have been reported.

### 3.8

#### **point of strike**

point where a lightning flash strikes the earth, or protruding object (e.g. structure, LPS, service, tree, etc.)

NOTE A lightning flash may have more than one point of strike.

### 3.9

#### **lightning current**

$i$

current flowing at the point of strike

### 3.10

#### **peak value**

$I$

maximum value of the lightning current

### 3.11

#### **average steepness of the front of short stroke current**

average rate of change of current within a time interval  $t_2 - t_1$

NOTE It is expressed by the difference  $i(t_2) - i(t_1)$  of the values of the current at the start and at the end of this interval, divided by  $t_2 - t_1$  (see Figure A.1).

**3.12****front time of short stroke current** $T_1$ 

virtual parameter defined as 1,25 times the time interval between the instants when the 10 % and 90 % of the peak value are reached (see Figure A.1)

**3.13****virtual origin of short stroke current** $O_1$ 

point of intersection with time axis of a straight line drawn through the 10 % and the 90 % reference points on the stroke current front (see Figure A.1); it precedes by  $0,1 T_1$  that instant at which the current attains 10 % of its peak value

**3.14****time to half value of short stroke current** $T_2$ 

virtual parameter defined as the time interval between the virtual origin  $O_1$  and the instant at which the current has decreased to half the peak value (see Figure A.1)

**3.15****flash duration** $T$ 

time for which the lightning current flows at the point of strike

**3.16****duration of long stroke current** $T_{\text{long}}$ 

time duration during which the current in a long stroke is between the 10 % of the peak value during the increase of the continuing current and 10 % of the peak value during the decrease of the continuing current (see Figure A.2)

**3.17****flash charge** $Q_{\text{flash}}$ 

time integral of the lightning current for the entire lightning flash duration

**3.18****short stroke charge** $Q_{\text{short}}$ 

time integral of the lightning current in a short stroke

**3.19****long stroke charge** $Q_{\text{long}}$ 

time integral of the lightning current in a long stroke

**3.20****specific energy** $W/R$ 

time integral of the square of the lightning current for the entire flash duration

NOTE It represents the energy dissipated by the lightning current in a unit resistance.

**3.21****specific energy of short stroke current**

time integral of the square of the lightning current for the duration of the short stroke

NOTE The specific energy in a long stroke current is negligible.

**3.22****object to be protected**

structure or service to be protected against the effects of lightning

**3.23****structure to be protected**

structure for which protection is required against the effects of lightning in accordance with this standard

NOTE A structure to be protected may be a part of a larger structure.

**3.24****service to be protected**

service connected to a structure for which protection is required against the effects of lightning in accordance with this standard

**3.25****lightning flash to an object**

lightning flash striking an object to be protected

**3.26****lightning flash near an object**

lightning flash striking close enough to an object to be protected that it may cause dangerous overvoltages

**3.27****electrical system**

system incorporating low voltage power supply components

**3.28****electronic system**

system incorporating sensitive electronic components such as communication equipment, computer, control and instrumentation systems, radio systems, power electronic installations

**3.29****internal systems**

electrical and electronic systems within a structure

**3.30****physical damage**

damage to a structure (or to its contents) or to a service due to mechanical, thermal, chemical and explosive effects of lightning

**3.31****injury of living beings**

injuries, including loss of life, to people or to animals due to touch and step voltages caused by lightning

**3.32****failure of electrical and electronic systems**

permanent damage of electrical and electronic systems due to LEMP

**3.33****lightning electromagnetic impulse**

LEMP

electromagnetic effects of lightning current

NOTE It includes conducted surges as well as radiated impulse electromagnetic field effects.

**3.34****surge**

transient wave appearing as overvoltage and /or overcurrent caused by LEMP

NOTE Surges caused by LEMP can arise from (partial) lightning currents, from induction effects in installation loops and as remaining threat downstream of SPD.

**3.35****lightning protection zone**

LPZ

zone where the lightning electromagnetic environment is defined

NOTE The zone boundaries of an LPZ are not necessarily physical boundaries (e.g. walls, floor and ceiling).

**3.36****risk** $R$ 

value of probable average annual loss (humans and goods) due to lightning, relative to the total value (humans and goods) of the object to be protected

**3.37****tolerable risk** $R_T$ 

maximum value of the risk which can be tolerated for the object to be protected

**3.38****lightning protection level**

LPL

number related to a set of lightning current parameters values relevant to the probability that the associated maximum and minimum design values will not be exceeded in naturally occurring lightning

NOTE Lightning protection level is used to design protection measures according to the relevant set of lightning current parameters.

**3.39****protection measures**

measures to be adopted in the object to be protected to reduce the risk

**3.40****lightning protection system**

LPS

complete system used to reduce physical damage due to lightning flashes to a structure

NOTE It consists of both external and internal lightning protection systems.

**3.41****external lightning protection system**

part of the LPS consisting of an air-termination system, a down-conductor system and an earth-termination system